con **128** is then selectively polished and removed using the SiO_2 film **127** as a stopper.

Further, the surface is treated with a TMAH (tetramethylammoniumhidroxide) solution. At this stage, in a peripheral portion, an IC circuit and the like are formed (not shown).

Thereafter, as shown in FIG. **29**, an Si_3N_4 film **129** having a thickness of 500 to 2000 Å is formed on the surface, and an n^+ type polysilicon layer **130** is formed which will serve as a stopper against excessive amplitudes of the electrode layer and the sensor. Following this, a BPSG film **131** is formed as a surface protection film. This film may be formed by an Si_3N_4 film or the like. A window portion **132** is then formed.

Then, as shown in FIG. **30**, the polysilicon **119** and the polysilicon **128** are etched through the window portion **132** with the TMAH solution.

In this manner, a sensor which comprises a movable portion (cantilever) which is entirely surrounded by an electrode and a stopper is obtained. In such a structure, when the weight portion is excited in a direction which is perpendicular to the substrate, as shown in FIG. **30**, since a>b and b is within the range of a, there will be almost no capacitance change created during detection of a yaw rate due to excitation. the relation a>b is attainable in the first embodiment as well.

FIG. **31** is a view which clearly shows more detail of the overall structure.

As described above, in the present example, since the stopper member **130** is disposed above the cantilever **102**, output is further increased, as compared with the above example, and destruction of the cantilever by excessive shock and the like is prevented.

That is, in the present example, in the first step, a groove of a predetermined depth is formed in the major surface of the monocrystalline silicon substrate to thereby form the beam which has the weight. In the second step, a pair of electrodes are formed which faced each other on the opposite sides of the groove in a substrate surface region and an inner wall of the groove which surrounds the weight in the direction of the surface of the substrate, while the first electrode is formed in a substrate surface region which will serve as the weight in a direction which is perpendicular to the surface of the substrate. In the third step, the groove is filled with a filling material and an electrode which faces the first electrode through the filling material is formed, and the major surface of the monocrystalline silicon substrate is smoothed. Next, in the fourth step, the major surface of the monocrystalline silicon substrate and the silicon substrate are joined to each other. In the fifth step, the back surface side of the monocrystalline silicon substrate **101** is polished by a predetermined amount to thereby make the monocrystalline silicon substrate thin. Lastly, in the sixth step, the filling material is etched from the back surface side of the monocrystalline silicon substrate, whereby the beam which has the weight is formed. As a result, the semiconductor mechanical sensor according to the present invention is completed.

It is to be noted that the present invention is not limited to the embodiments described above. Rather, two pairs of the sensor units may be arranged in directions perpendicular to each other in order to detect yaw rates in the two axial directions. Further, the present invention is not limited to a cantilever. The present invention is also not limited to detection of a yaw rate. For instance, the excitation electrode of the embodiments above may be replaced with an electrode which detects a capacitance of displacement in an up-to-down direction so that the present invention is applied to a mechanical sensor which is capable of detecting displacements in two directions.

As heretofore described in detail, the present invention creates effects by which a yaw rate sensor of the beam excitation type capacity detection method and a method of manufacturing the same are obtained, and a semiconductor mechanical sensor which can detect movement in two or three directions and a method of manufacturing the same are obtained.

What is claimed is:

1. A semiconductor mechanical sensor comprising:

a movable portion which is formed on a substrate and has a first face on which a first electrode is provided and a second face on which a second electrode is provided;

a first correspondent electrode and a second correspondent electrode formed at the position facing said first electrode and second electrode respectively;

a first outgoing contact electrode contacted to said first electrode;

a second outgoing contact electrode contacted to said first correspondent electrode;

a third outgoing contact electrode contacted to said second electrode;

a fourth outgoing contact electrode contacted to said second correspondent electrode;

wherein said first to fourth outgoing contact electrodes are provided on substantially the same plane and mechanical force which acts in one direction of said moveable portion is detected by said first electrode and said first correspondent electrode and mechanical force which acts in another direction different from said one direction of said movable portion is detected by said second electrode and second correspondent electrode.

2. A semiconductor mechanical sensor comprising:

a movable portion which is formed on a conductive portion arranged on a substrate through a predetermined gap and which has a first face on which a first electrode is provided and a second face on which a second electrode is provided;

a correspondent electrode formed at the position facing said first electrode and second electrode respectively;

a first outgoing contact electrode contacted to said first electrode;

a second outgoing contact electrode contacted to said first correspondent electrode;

a third outgoing contact electrode contacted to said second electrode;

a fourth outgoing contact electrode contacted to said second correspondent electrode;

wherein said first to fourth outgoing contact electrodes are provided on said conductive portion, and mechanical force which acts in one direction of said movable portion is detected by said first electrode and said first correspondent electrode, and mechanical force which acts in another direction different from said one direction of said movable portion is detected by said second electrode and said second correspondent electrode.

3. A semiconductor mechanical sensor comprising:

a first electrode which is formed on a conductive portion arranged on a substrate;

a movable portion which is formed on said conductive portion through a predetermined gap and which moves in a direction substantially perpendicular to said substrate;